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E – 4209

Reg. No. : ....

Name : ....

Fourth Semester B.Tech. Degree Examination, August 2018
(2013 Scheme)
13.406 : FORMAL LANGUAGES AND AUTOMATA THEORY (R)

Time : 3 Hours   Max. Marks : 100

PART – A

Answer **all** questions. **Each** question carries **4** marks.

1. Construct DFA to accept
   a) $L_1 = \{x \mid x \in \{0, 1\}^*$ and x does not contain the substring 010$\}$.
   b) $L_2 = \{w \mid w \in \{a, b\}^*$ and x starts with ab and end with ba$\}$.
2. Prove that every finite language is regular.
3. Is the Language $L = \{a^n b^n \mid \geq 2\}$ context free ? Justify your answer.
4. Suppose that the Stack in Non-deterministic PDA is replaced by a linear queue. Give an example for a language.
   a) for which no NPDA exists, but can be accepted by some machine with the modification suggested above.
   b) for which NPDA exists, but no machine of the modified type accepts it.
5. What is meant by offline Turing Machine ?

PART – B

Answer any **one full** question from **each** Module. **Each full** question carries **20** marks.

Module – I

6. a) Prove that corresponding to any Mealy Machine, there exists an equivalent Moore Machine. **12**

P.T.O.

b) Design a Mealy Machine to determine the residue mod 5 for each binary string which when interpreted as a non negative integer. **8**

OR

7. a) State and prove the equivalence of NFA's with and without null Transitions. **10**

b) Given the NFA N = ({A, B, C}, {0, 1} , δ, A, {B}) where the transition function δ is defined as follows.

$\delta(A, 0) = \{A, B\}$ $\delta(A, 1) = \{B\}$ $\delta(A, \epsilon) = \{B\}$

$\delta(B, 0) = \{B, C\}$ $\delta(B, 1) = \{B, C\}$ $\delta(B, \epsilon) = \{C\}$

$\delta(C, 0) = \{A\}$ $\delta(C, 1) = \{B, C\}$ $\delta(C, \epsilon) = \{B\}$.

Eliminate the The Null Transitions of this NFA and obtain an equivalent NFA which does not have any Null Transitions. Convert this NFA to DFA. **10**

Module – II

8. a) Prove that if L_1 and L_2 are regular languages, then

i) $L_1 \cap L_2$ is regular

ii) $L_1 \cup L_2$ is regular

iii) $L_1 \backslash L_2'$ is regular. **12**

b) Prove that the language $L = \{a^n b^n | n \geq 0\}$ is irregular. **8**

OR

9. a) Obtain the minimal state DFA corresponding to the Finite state acceptor shown in Figure 1. **12**

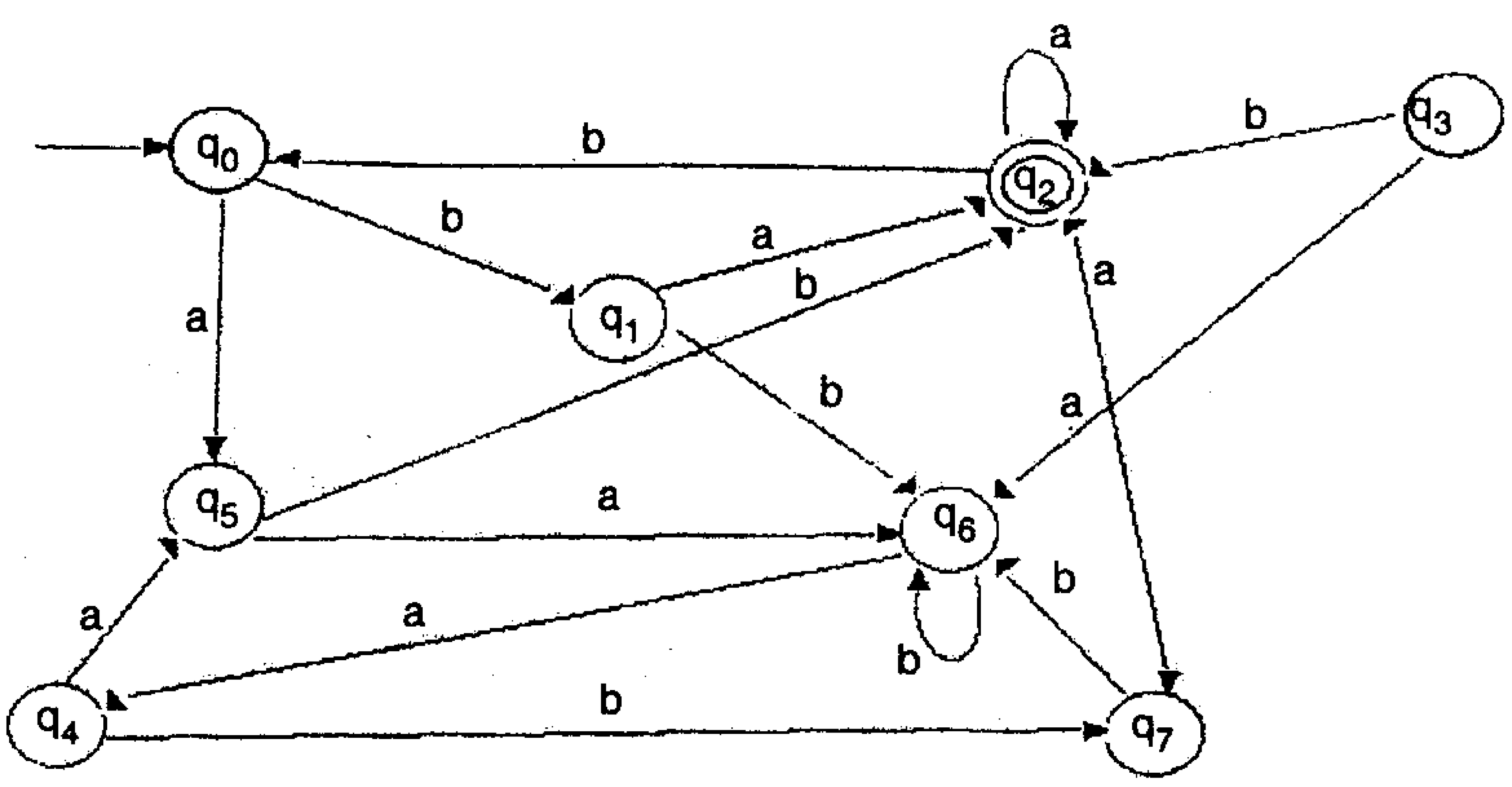

Figure 1 : DFA for question 9 (a)

b) Write regular expressions for the following languages.

i) $L_1 = \{x \mid x \in \{a, b\}^*$ and x contains the substring ab$\}$.

ii) $L_2 = \{x \mid x \in \{a, b\}^*$ and the starting and ending symbols of x are the same.$\}$

iii) $L_3 = \{x \mid x \in 0, 1\}^*$ and $|x|$ is a multiple of 3$\}$.

iv) $L_4 = \{x \mid x \in \{0, 1\}^*$and $n_0(x) + n_1(x) \leq 6\}$.

Module – III

10. a) State and prove the Pumping Lemma for context free languages . 12

b) Design an NPDA accepting the set $L = \{ww^R \mid w \in 0, 1^*\}$. Write the computation of the NPDA for the string 011110. 8

OR

11. a) Prove that the language $L = \{a^n b^n c^{n-1} \mid n \geq 0\}$ is not context free. 10

b) Explain the Chomsky Hierarchy of formal Languages. 10

Module – IV

12. a) Show the equivalence of multi-tape and conventional TM. 15

b) Bring out the concept of Recursively Enumerable Languages and Recursive languages. 5

OR

13. a) Design a Turing machine to find the product of two integers. 10

b) Is Universal language recursively enumerable ? Give proof. 10
